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Ku-band LNB line-up

In this article I document the internal construction of several off-the-shelf Ku-band low noise block downconverters (LNB/LNBF) from the perspective of amateur radio applications.

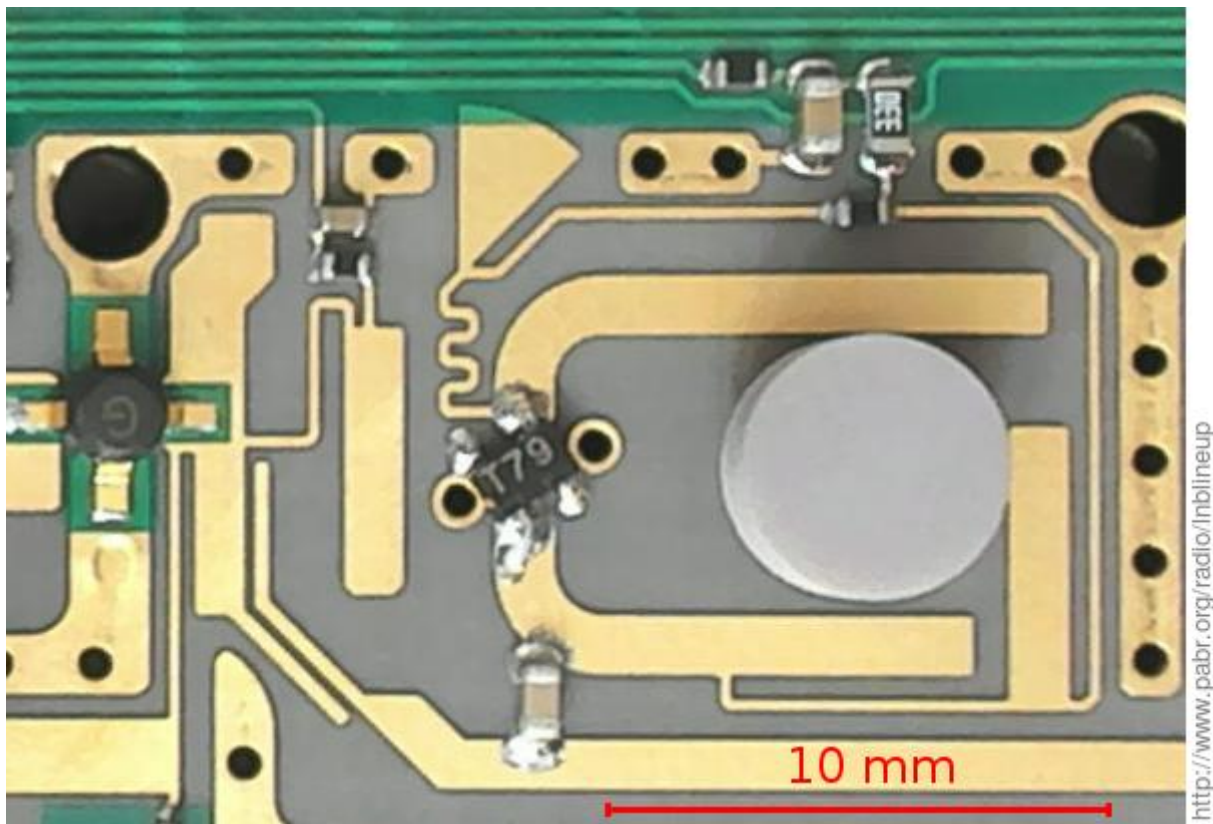


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1. Motivation

I recently made some modifications and applications such as:

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- Installing a crystal with a slightly different frequency. This may help receive the amateur 3 cm band with off-the-shelf satellite TV receivers.
- Replacing the crystal with a more accurate TCXO or OCXO. This is convenient for receiving narrow-band transmissions.
- Using an external clock reference. This may be useful for radioastronomy applications.
- Supplying power without a bias tee.
- Mounting several LNBs close together.

These concerns are mostly about mechanical construction and ease of access to key components. RF performance was not considered at all.

Hopefully these notes and pictures will be of interest to others:

- Radio amateurs with unusual requirements may find this information useful to choose among an abundance of models, as the first amateur 3 cm geostationary relays are expected to be deployed soon.
- Those trained in the dark art of microwave engineering may be entertained by the fascinating variety of microstrip patterns found inside these devices.
- Mass-market product designers may find it interesting to identify all the small decisions which ultimately lead to significant price differences between models with mostly identical specifications.

2. Related work

There is a long tradition of adapting mass-market LNBs for amateur radio, starting probably with U.S. C-band TVRO equipment in the late 1970s. Articles can be found in amateur radio journals.

One popular online resource with information about other LNBs is <https://uhf-satcom.com/blog/ku-band-pll-lnb-s>.

3. Background information on LNBs

3.1. "Universal" LNBs

All LNBs examined here are of the so-called European "Universal" type, i.e. they can receive all four sub-bands resulting from combinations of two polarizations (horizontal / vertical) and two frequency ranges (low / high). In the U.S. they are sometimes called "LNBF" (LNB and Feedhorn), possibly because early C-band equipment had separate horns and LNBs.

Technically their frequency coverage is mostly in X band (8..12 GHz), but the [fixed-satellite service](#) in Europe is commonly considered to be an extension of Ku band (12..18 GHz). Hence, these products are marketed as "Ku-band LNBs".

3.2. Single / Twin / Quad / Octo / Quattro

A "Single

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supply:

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al. It
power

- 13 V selects vertical polarization.
- 18 V selects horizontal polarization.
- No overtone selects the 9.75 GHz LO. This downconverts the low range (10.70..11.70 GHz) to 950..1950 MHz.
- A 22 kHz overtone selects the 10.60 GHz LO. This downconverts the high range (11.70..12.75 GHz) to 1100..2150 MHz.

A "Twin" LNB has two F-type connectors and behaves like two independent "Single" LNBs. If one of the connectors does not receive power, it will not output an IF signal.

A "Quad" LNB is like a "Twin" LNB, except with four independent outputs. Similarly, an "Octo" LNB offers eight independent outputs.

A "Quattro" LNB outputs all four sub-bands, each on a dedicated connector. As long as at least one connector receives power, all four outputs are active.

3.3. Dimensions

Most LNBs have a 40 mm diameter neck that fits inside a bracket attached to the dish. The LNB can be rotated to account for polarization skew. LNBs with a long neck can also be moved along the main axis to match the focal length of the reflector.

"Bullet"-style LNBs are intended for multi-satellite setups where two or more horns must be packed tightly in the focal region of a single dish. They typically have a 23 mm diameter neck and a narrow dielectric lens instead of a wide horn.

3.4. Local oscillator

Mainstream LNBs generate their LO frequency either with a [dielectric resonator](#) oscillator (DRO) or with a crystal-driven [phase-locked loop](#) (PLL). PLLs are generally preferred due to their better frequency stability (about 25 kHz vs 250 kHz). However, both technologies exhibit significant temperature-dependent drift.

One notable feature of DROs is that they can be retuned simply by turning a screw that is often accessible without disassembling the sealed cover.

Crystals are known to age; their resonant frequency can drift by several ppm per year.

Each PLL IC is rated for a specific reference frequency, typically 25 MHz. Datasheets rarely specify limits on that value. The only way to determine how much a LNB can be "pulled" up or down in frequency is by testing.

3.5. Noise figure

Most manufacturers claim a N.F. of 0.1 dB, which is commonly regarded as unrealistic.

3.6. Output power

There are reports that some LNBs can output as much as 20 dBm (100 mW) under saturation. This can be a concern when connecting directly to some receivers.

Table 1.

PlutoSI
RTL-SI
LimeSI

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4. General findings

4.1. PLL / DRO

All modern "Single" LNBs turned out to be PLL-based, even those not explicitly advertized as such. No TCXOs were found - only inexpensive crystals.

Surprisingly, many "Twin" and "Quattro" models still use DROs. It is unclear whether there is a technical reason for this, or whether manufacturers are not refreshing their product lines because the market for these models is smaller.

4.2. Crystal frequency

Most PLL models use a 25 MHz crystal. Only those based on RDA chips have a 27 MHz reference, which implies fractional PLL ratios to produce 9750 MHz and 10600 MHz.

For a given output frequency, a fractional-N PLL can perform better than an integer-N PLL because it can use a higher reference frequency. But this is not what's being done in these 27 MHz models; this raises concerns about spurious noise.

4.3. Construction

Most models are very similar in construction. Inside a plastic shell, a cast metal body forms the waveguide and cavities for one or more circuit boards. H and V probes extend from the main PCB into the waveguide, usually one straight and the other with a 90° bend.

Only a few models stand out with square waveguides, conductive mesh gaskets, weatherproof plastic shells, metric screws, or unusual mechanical configurations.

Some models have two layers of shielding: a cast metal cover on the microwave sections of the PCB, and a thin lid for the whole electronic cavity. The flexible lid clips between the walls of the chassis. On the one hand, this creates a good continuous RF seal. On the other hand, these lids are hard to remove, even after scrapping the sealing compound.

4.4. RF circuits

Despite a variety of board layouts and dimensions, the circuits are all very similar. The pictures below are scaled to about 40 µm per pixel (click on thumbnails for full size) and oriented so that signals flow generally from left to right. Areas without solder mask are microwave sections. The probe connections are recognizable as large solder blobs in the left half of the pictures. From there, signals go through one, two, or three stages of transistor amplification, and then into a mixer. Mixing is typically done inside the PLL IC; DRO-based models mix with transistors instead. Depending on the LNB type

(Single/Twin/Quad/Quattro), one or more IF signals are selected, filtered and output via decoupling capacitors. Solder blobs on the right side lead to the F-type connectors.

Microwave sections are usually surrounded with ground traces that match the inner walls of the cast metal cover. DRO cavities are always heavily shielded.

The unlabeled components are usually integrated circuits (ICs) for PLLs or mixers. Some models use discrete components for these functions.

Some models use discrete components for these functions.

A few models use discrete components for these functions.

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The following ICs appear to be popular:

- **"3566"**. Found in almost all the low-cost models. 25 MHz PLL.
- **RDA 3565ES**. Found in higher-end models. 27 MHz PLL, mixer, bias controller.
- **Rafael Micro RT320M**. Found in one recent design. 25 MHz PLL, twin mixer.
- **NXP TFF1015HN**. A 2011 IC found in one low-cost design. 25 MHz PLL, mixer. Full datasheet available, but EOL.
- **NXP TFF1044HN**. A 2015 IC found in recent designs. Dual 25 MHz PLL, quad mixer, Quad/Quattro outputs. Full datasheet and application note available.
- **Rafael Micro RT348M**. Found in one very recent design. Dual 25 MHz PLL, quad mixer.

4.5. Power supply

Power from the coaxial connectors goes through a low-pass filter (thin wiggly line and capacitor) to a voltage regulator. All models use linear regulators, typically 78x06. Only one model was found to run at 3.3 V. Current ratings give an indication about the maximum consumption of the LNB and/or the derating factor that the designers chose to apply:

- 78L06: 100 mA
- 78N06: 300 mA
- 78M06, 78D06: 500 mA

Linear regulators are less noisy than switch-mode converters, but also less efficient. A 6 V 200 mA LNB wastes 1.4 W at 13 V and 2.4 W at 18 V. Only very long, low cost steel core cables would need that much margin to compensate for voltage drop. In controlled conditions, a 9 V supply is often sufficient. However, the extra heat dissipation may be useful in wet weather.

Twin/Quad/Quattro models have either several regulators with diodes downstream, or a single regulator with diodes upstream. The latter option is less expensive but may result in more cross-talk between the IF outputs.

4.6. Band selection

Affiliate links

 Bias tee 950..2300 MHz F-type Buy from amazon.co.uk	 Bias tee 5..2400 MHz F-type Buy from amazon.co.uk
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Voltage from the coaxial connectors is tapped upstream of the regulators for sub-band selection. Recent ICs implement 13/18 V and 0/22 kHz detection internally. Older designs use voltage dividers and RC filters.

4.7. Supply chain issues

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model.

4.8. Concluding remarks

A few circuit boards are obviously derived from the same reference design, which is a good thing considering the expertise that goes into a microstrip board. Still, the variety of designs is surprising for a class of products with standardized specifications. No two models turned out to be rebranded clones of the same OEM product, at least not within the same geographical market.

In general, sales prices appear to reflect the complexity of the designs. It is intriguing that LNBs can be had for only a few euros, or even 1 USD if you buy a whole shipping container. The cost of the LNB is almost negligible in a satellite installation; for most consumers, it is certainly wiser to invest in a quality LNB than to climb on one's roof every few years to replace cheap units.

5. Future work: high-end models

Most of the LNBs tested here sell for 20 EUR or less. Maybe higher-end models use completely different components families and construction techniques.

The following features can be found in more expensive devices:

- C120 mounting flange for feedhorns with non-standard F/D ratios
- N or SMA connectors
- Better oscillator (1 ppm) for narrowband signals
- Extended temperature range (-20..+70°C)
- "Wideband" output (downconverting 10.70..12.75 GHz to 300..2350 MHz with a 10.40 or 10.41 GHz LO)
- Custom LO frequencies
- Fiber optic output
- Input for external clock reference, typically 10 MHz.

6. LNB tear-downs

Table 2. Main characteristics

Brand	Model	Type	Neck (mm)	Crystal (MHz)	PLL/Mixer	Source
Octagon	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept					
McLearn						
Opticum						
Opticum						
Diesl	Universal Single	Single	40	25	3566E NQ703	Amazon (affiliate link)
4TV	4TV HD	Single	40	25	3566E EP547	AliExpress
SuperHDSat	SR-320 v1	Single	40	25	3566E DQ693	AliExpress
Star Com	SR-320 v2	Single	40	25	3566E DQ693	AliExpress
BWEI	BT-180	Single	40	25	3566E EP787	AliExpress
Philips	SX1019	Single	40	(DRO)	Microstrip ? Diode ?	(Obsolete)
HD-Line	HD-BP2	Twin	40	27	RDA 3565ES (x2)	Amazon (affiliate link)
Megasat	Multifeed	Twin	23	(DRO)	XH8 (x4)	Amazon (affiliate link)
Octagon	OTLSO 1306	Twin	40	27	RDA 3565ES (x2)	Amazon (affiliate link) (25/27 MHz random)
Octagon	OTLSO 1609	Twin	40	25	RT320M	Amazon (affiliate link) (25/27 MHz random)
HB-Digital	UHD 202 S 201901	Twin	40	25 ?	RT320	Amazon (affiliate link)
Pro-Line	P-40	Quattro	40	(DRO)	XH8 (x4)	Amazon (affiliate link)
Venton	EXL-Q	Quattro	23	(DRO)	XH8 (x4)	Amazon (affiliate link)
HB-Digital	UHD 414 201612	Quattro	40	(DRO)	XH8 (x4)	Amazon (affiliate link) (DRO/PLL random)
HB-Digital	UHD 414 201705	Quattro	40	25 ?	NXP T1044	Amazon (affiliate link) (DRO/PLL random)
Triax	304832	Quattro	40	25	RT348M	
Opticum	LRP-04H	Quattro	40	25	NXP T1044	Amazon (affiliate link)
PremiumX	Deluxe Quattro	Quattro	40	(DRO)	4R S 64 (x2), 4R S 59 (x2)	Amazon (affiliate link)
Inverto	5448	Quattro	40	25	RT348M	

6.1. Octagon OSLO 1609



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This is an inexpensive model with a simpler design than its "Twin" variant (OTLSO).

Interestingly, the PCB is tilted at 45°. As a result, both probes have identical 45° bends, whereas most LNBs have one straight probe and the other bent at 90°. Maybe this is done to ensure balanced performance between the two polarizations, or to reduce the length of the slits through which the probes enter the waveguide.

Related model . There are reports of an earlier version labeled "1301", identical to the Avenger PLL321S. It uses a RDA3560M and a 27 MHz crystal. Useful links:

- Analysis of PLL321S: <http://f1chf.free.fr/LNBPLL/inside.pdf>
- Various mods and measurements: http://www.hb9afo.ch/articles/pll-lnb/10ghz_pll-lnb.htm

Related model . There is also a version labeled "1404" (details unknown).

Affiliate links



[LNB OSLO](#)

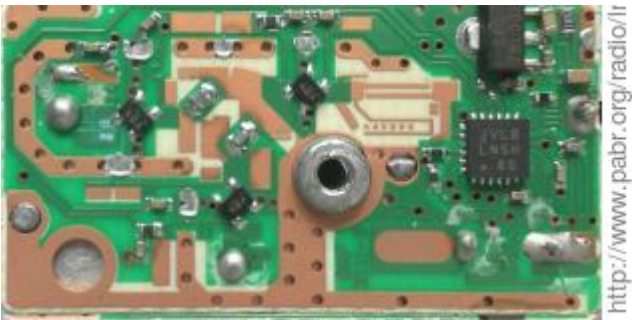


Table 3. Octagon OSLO 1609 data

Type	Single	
Unit price (approx)	8	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	65	dB
Rated flatness/26MHz		dB
PCB size	35x21	mm ²
Stage 1	103 (x2)	
Stage 2	103	
Crystal	25.000H628	
PLL/mixer IC	3566Q EQ84	
Regulator	78N06G	
Screws	3	
RF pads	1	
Labels	CE, WEEE	

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6.2. McLean MCTV-668 (GKF-2111-S ?)



(Click image to enlarge)

This is an intriguing model with an unidentified PLL/mixer IC running at 3.3 V. The through-hole crystal is mounted on the back side.

Table 4. McLean MCTV-668 data

Type	Single	
Unit price (approx)	6	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	65	dB
Rated flatness/26MHz	0.5 ?	dB
PCB size	35x19	mm ²
Stage 1	V84 (x2)	
Stage 2	V84	
Crystal	25.000M08	
Rated L.O. accuracy	1000 ?	kHz
over temperature range	2000 ?	kHz
PLL/mixer IC	JVLB LN5H 8G	
Regulator	78L33	
Rated current	80 ?	mA
Screws	2	
Labels	CE, WEEE	

Affiliate links

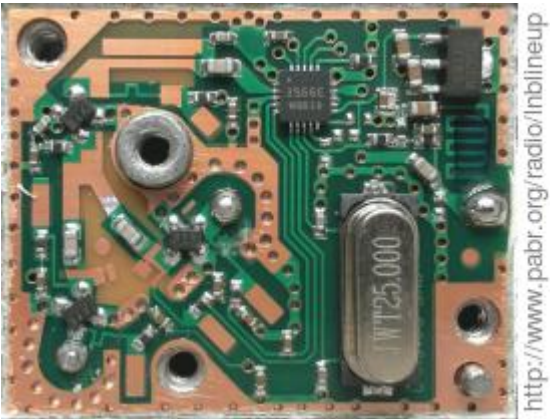


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6.3. Opticum LSP-02G



(Click image to enlarge)

This a basic model, compact and inexpensive.

Table 5. Opticum LSP-02G data

Type	Single	
Unit price (approx)	6	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60	dB
Rated flatness/26MHz		dB
PCB size	31x25	mm ²
Stage 1	V75 (x2)	
Stage 2	V75	
Crystal	JWT25.000	
PLL/mixer IC	3566E NQ819	
Regulator	78S06M	
Screws	3	
Labels	CE, WEEE	

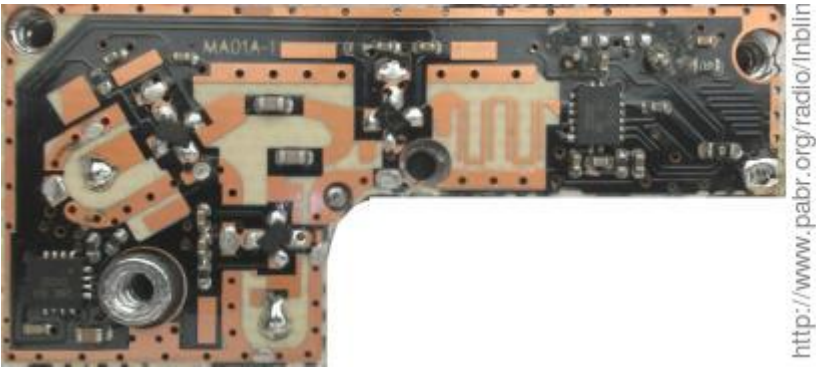
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6.4. Opticum Robust (Amiko L-107)



(Click image to enlarge)

This model has a small non-rectangular circuit board. The through-hole crystal is mounted on the back side.

The PLL/mixer is the well-documented NXP TFF1015HN.

Related model . Apparently sold as Amiko L-107 in the U.S.A.

Related model . The Goobay 67321 has a rectangular PCB with an almost identical layout and a SMD crystal.

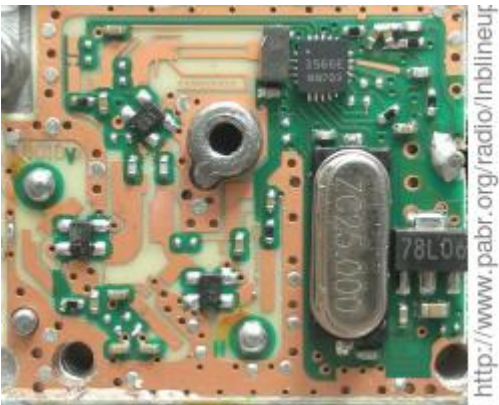
Table 6. Opticum Robust data

Type	Single	
Unit price (approx)	6	EUR,USD
Neck di	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept	
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	47x22	mm ²
Bias IC	CHMC SE4 D4202	
Stage 1	V75 (x2)	
Stage 2	FX	
Crystal	J25F6S8	
PLL/mixer IC	T1015 04 04 SD522	
Regulator		
Screws	3	
Labels	CE, WEEE	

Affiliate links




6.5. Diesel Universal Single



(Click image to enlarge)

This is a basic model, compact and inexpensive, but with interesting microstrip patterns.

The waveguide has a square cross-section.

Related model . The Sharp BS1K1EL100A has a similar board layout, but a different PLL/mixer IC.

Table 7. Diesl Universal Single data

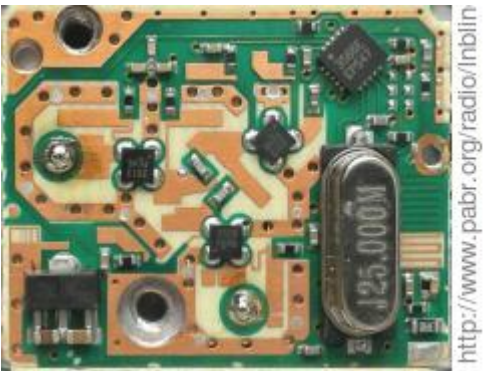
Type	Single	
Unit price (approx)	6	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	28x24	mm ²
Stage 1	103 (x2)	
Stage 2	103	
Crystal	ZC25.000	
PLL/mixer IC	3566E NQ703	
Regulator	78L06	
Screws	4	
RF pads	1	
Labels		

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6.6. 4TV 4TV HD



(Click image to enlarge)

This is a basic model with the distinguishing feature that the cast metal enclosure is not sealed. Instead, the plastic shell is weatherproof (and hard to disassemble). Also, the F-type connector is attached to the cover rather than to the main body.

Affiliate links

Related model . Apparently also sold as "LNB G110".

Table 8. 4TV 4TV HD data

Type	Single	
Unit price (approx)	4	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60	dB
Rated flatness/26MHz		dB
PCB size	27x22	mm ²
Stage 1	3513 FK46 (x2)	
Stage 2	3513 FK46	
Crystal	J25.000M	
PLL/mixer IC	3566E EP547	
Regulator	78L06	
Screws	2	
Labels	CE	

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6.7. SuperHDsat SR-320 v1



(Click image to enlarge)

A ultra-low-cost model. The unit I examined had a missing screw hidden by the sealant compound. No CE mark.

[Affiliate links](#)

Related model . There is a completely different model also branded as "SR-320": [Section 6.8, “Star Com SR-320 v2”](#).

Table 9. SuperHDSat SR-320 v1 data

Type	Single	
Unit price (approx)	3	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	65	dB
Rated flatness/26MHz		dB
PCB size	47x15	mm ²
Stage 1	10F (x2)	
Stage 2	10F	
Crystal	25.000	
PLL/mixer IC	3566E DQ693	
Regulator	78L06	
Screws	3	
Labels		

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6.8. Star Com SR-320 v2



(Click image to enlarge)

This is a ultra-low-cost model. The through-hole crystal is mounted on the back side. The unit I examined had insufficient sealing. No CE mark.

[Affiliate links](#)

Related model . There is a completely different model also branded as "SR-320": [Section 6.7, "SuperHDSat SR-320 v1"](#).

Table 10. Star Com SR-320 v2 data

Type	Single	
Unit price (approx)	3	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	34x14	mm ²
Stage 1	10x	
Stage 2	10T	
Crystal	EE25.000M	
PLL/mixer IC	3566E DQ693	
Regulator	78L06	
Screws	2	
Labels		

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6.9. BWEI BT-180



(Click image to enlarge)

This is a ultra-low-cost LNB, with a plain layout but otherwise using the same components as the others. Comes unbranded and without a CE mark.

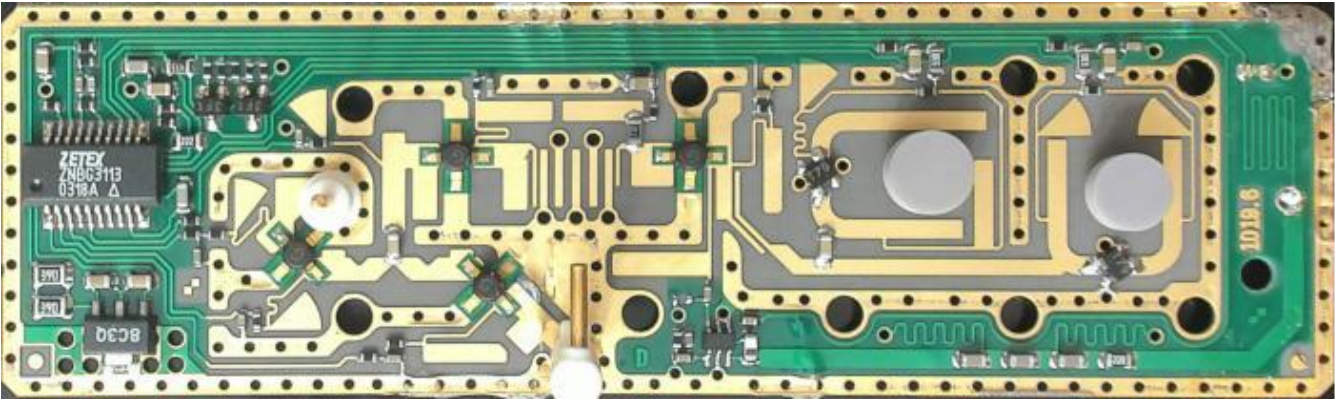
Affiliate links

Table 11. BWEI BT-180 data

Type	Single	
Unit price (approx)	2.5	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	58-65	dB
Rated flatness/26MHz		dB
PCB size	35x22	mm ²
Stage 1	V75 (x2)	
Stage 2	V75	
Crystal	H25.000M-20	
PLL/mixer IC	3566E EP787	
Regulator	78S06	
Screws	4	
Labels		

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6.10. Philips SX1019



(Click image to enlarge)

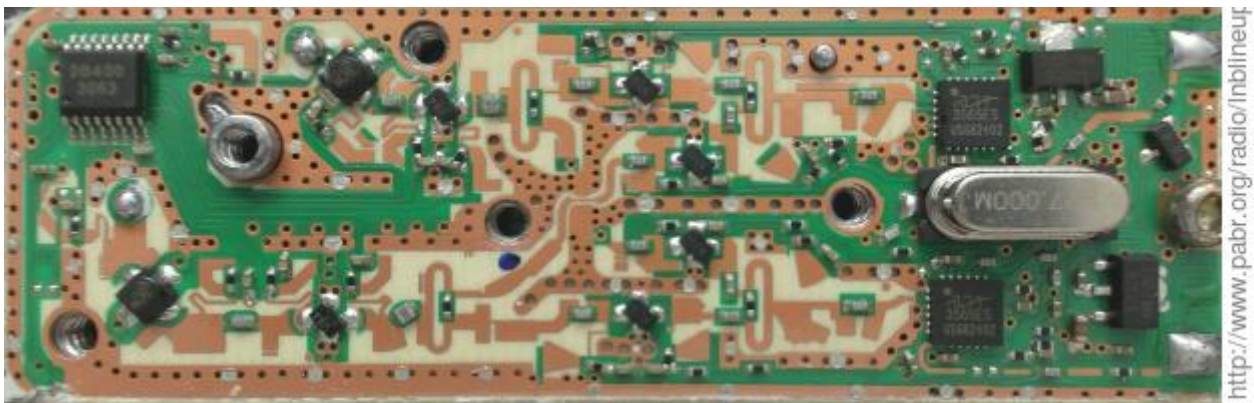
This is a historical model made in Germany, possibly in the late 1990s or early 2000s. The plastic shell is weatherproof and welded around the F-type connector. The thin circuit board is riveted between the main body and a backing shield. Probes are apparently gold plated and held in place by PTFE washers. The main IC is a ZNBG3113 bias controller and I.F. switch.

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Table 12. Philips SX1019 data

Type	Single	
Unit price (approx)	?	EUR,USD
Neck di	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept	
Neck le		
Apertur		
Cap dia		
Rated noise factor	?	dB
Rated gain	?	dB
Rated flatness/26MHz		dB
PCB size	84x25	mm ²
Bias IC	ZETEX ZNBG3113 0318A	
Stage 1	"G" (x2)	
Stage 2	"G"	
Stage 3	"G"	
Crystal	DRO + T79 (x2)	
PLL/mixer IC	Microstrip ? Diode ?	
Regulator	8C3Q	
RF pads	2	
Rivets	11	
Labels	CE	

6.11. HD-Line HD-BP2



(Click image to enlarge)

This is a sophisticated design with a nice symmetrical board layout. A single crystal apparently drives the two PLL/mixer ICs. There is free space in the enclosure near the gold-plated output connectors.

Table 13. HD-Line HD-BP2 data

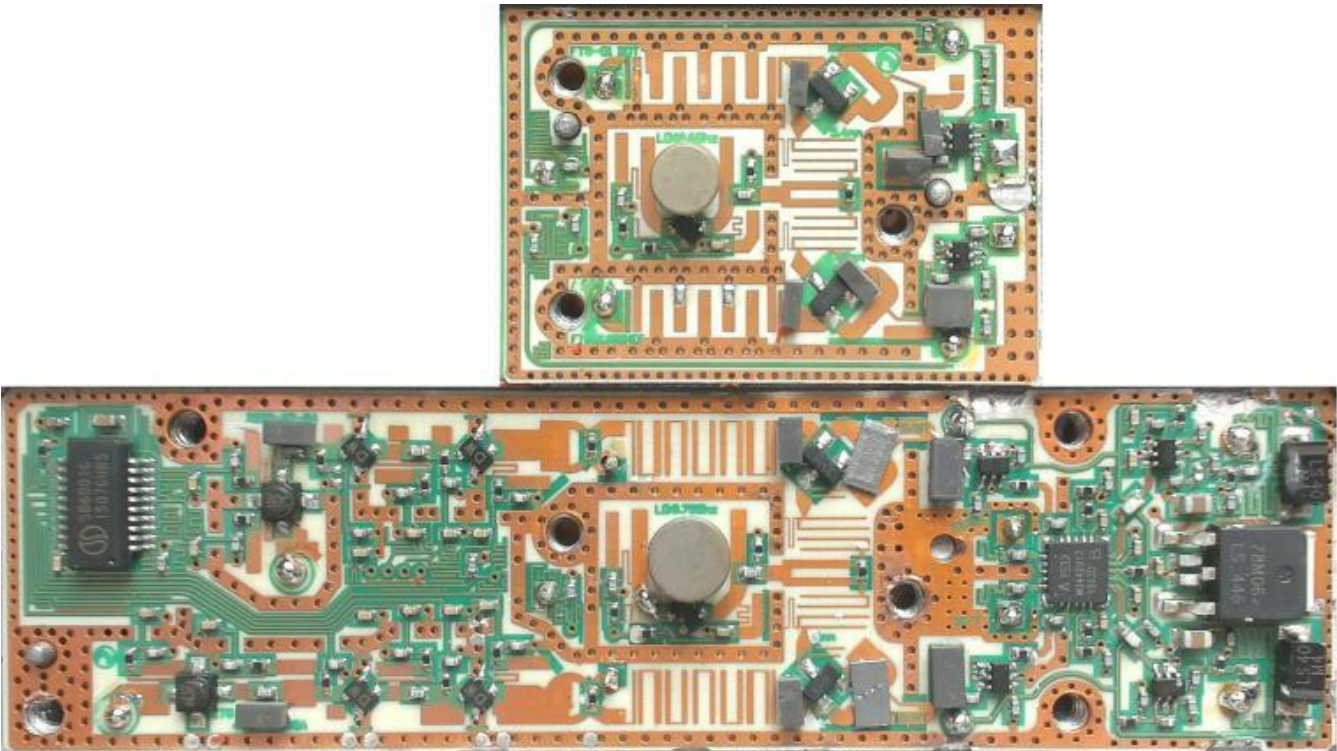
Type	Twin	
Unit price (approx)	20	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	62	dB
Rated flatness/26MHz		dB
PCB size	73x24	mm ²
Bias IC	D8400 3063	
Stage 1	3Y C A205 (x2)	
Stage 2	V84 (x2)	
Stage 3	t7N (x4)	
Crystal	H27.000M	
PLL/mixer IC	RDA 3565ES (x2)	
Regulator	78S06M (x2)	
Screws	6	
Labels	CE, WEEE	

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6.12. Megaset Multifeed



http://www.pabr.org/radio/lnblineup

(Click image to enlarge)

This is a "bullet"-style LNB with a narrow head and 23 mm diameter neck followed by a 40 mm diameter section. The two circuit boards are quite sophisticated, but use DROs. Four transistor-based mixers feed into an AMICCOM A7533 switch.

The dielectric diameter is 23 mm.

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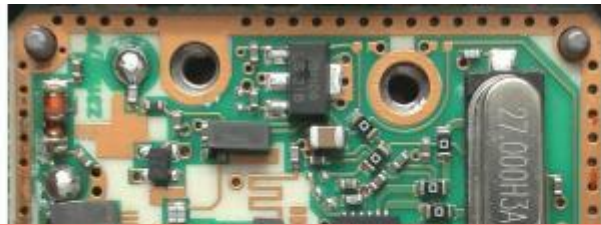


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Table 14

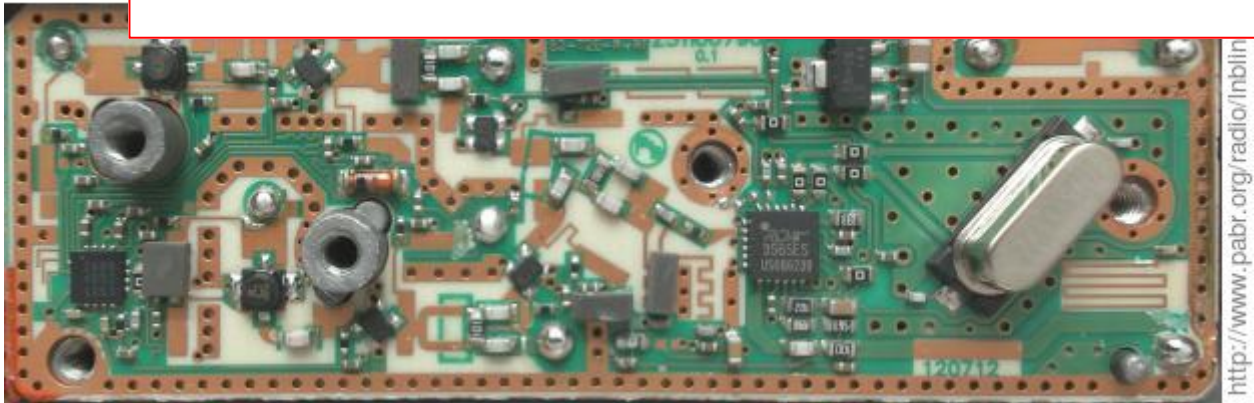
Type	Twin	
Unit price (approx)	17	EUR,USD
Neck diameter	23	mm
Neck length	31	mm
Aperture diameter		mm
Cap diameter	30	mm
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	91x25 + 37x26	mm²
Bias IC	SB6001G 1507GUB5	
Stage 1	53 C A042 (x2)	
Stage 2	DW (x2)	
Stage 3	DW (x2)	
Crystal	DRO + NDt (x2)	
PLL/mixer IC	XH8 (x4)	
Regulator	78M06	
Screws	9	
RF pads	20	
Labels	CE	

6.13. Octagon OTLSO 1306 (Amiko L-203)



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(Click image to enlarge)

This model is popular in the amateur radio community. The second PLL/mixer is in a dedicated shielded cavity.

Links:

- TCXO mod: http://www.dg0opk.darc.de/Octagon_LNB_mod_March2017.html
- External 27 MHz reference mods: <http://www.earf.co.uk/ocxolnb.html>, <http://www.g4jnt.com/OctagonExtLo.pdf>, http://microbandas.es/doku.php?id=microperlas:accesorios:lnb_disciplinado, http://www.df9np.de/Contents/TVSat_LNB.pdf
- Replacement PCB for 10 MHz reference: <https://loetlabor-jena.de/doku.php?id=projekte:3cmlpllnb:start>

Affiliate links



[LNB OTLSO \(random 25/27 MHz\)](#)

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Related model . Apparently sold as Amiko L-203 in the U.S.A.

Related model . As of October 2018, this model can still be found in the supply chain, but a completely redesigned variant is being rolled out with the same product name and SKU: [Section 6.14, "Octagon OTLSO 1609"](#). "1306" and "1609" refer to markings near the CE logo on the sticker.

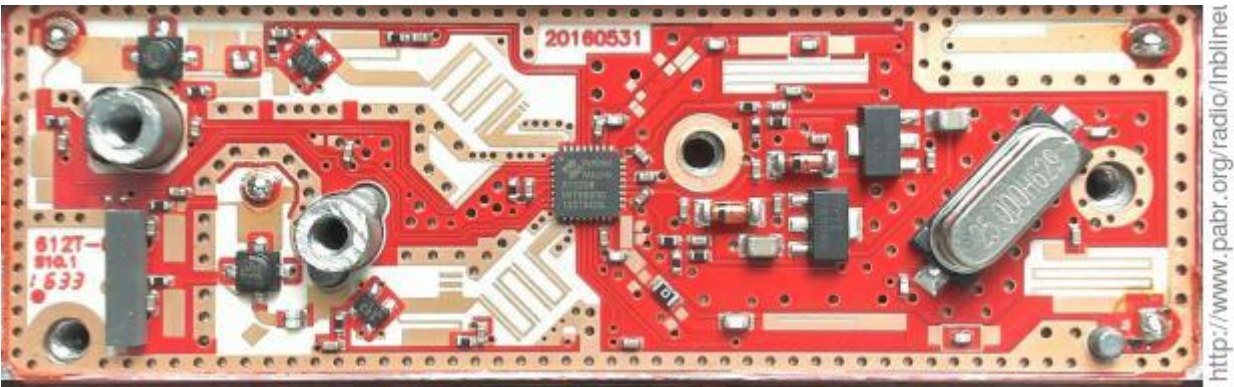
Related model . There are also reports of an earlier, almost identical version labeled "1301", possibly with a RDA3560M instead of the RDA3565ES.

Table 15. Octagon OTLSO 1306 data

Type	Twin	
Unit price (approx)	15	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60..65	dB
Rated flatness/26MHz		dB
PCB size	73x24 + 36x24	mm²
Bias IC	ZABG 4002 1251	
Stage 1	29 C A373 (x2)	
Stage 2	V75 (x2)	
Stage 3	V75 (x4)	
Crystal	27.000 (x2)	
PLL/mixer IC	RDA 3565ES (x2)	
Regulator	78H06 (x2)	
Metric screws	5+3	
RF pads	8+7	
Labels	CE	

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6.14. Octagon OTLSO 1609



(Click image to enlarge)

This is a redesign of the OTLSO, identified by "1609" near the CE mark on the sticker. Only two stages of transistor amplification, twin-mixer IC, 25 MHz crystal instead of 27 MHz. The board layout is simple and elegant thanks to the dedicated Rafael Micro IC, although it has obviously been tailored to fit in the same cast metal enclosure as the earlier variant.

Related model . [Section 6.13, “Octagon OTLSO 1306 \(Amiko L-203\)”](#)

Table 16. Octagon OTLSO 1609 data

Type	Twin	
Unit price (approx)	15	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60..65	dB
Rated flatness/26MHz		dB
PCB size	72x23	mm²
Stage 1	FET (x2)	
Stage 2	103 (x2)	
Crystal	25.000H629	
PLL/mixer IC	RT320M	
Regulator	78N06G (x2)	
Metric screws	5	
RF pads	3	
Labels	CE, WEEE	

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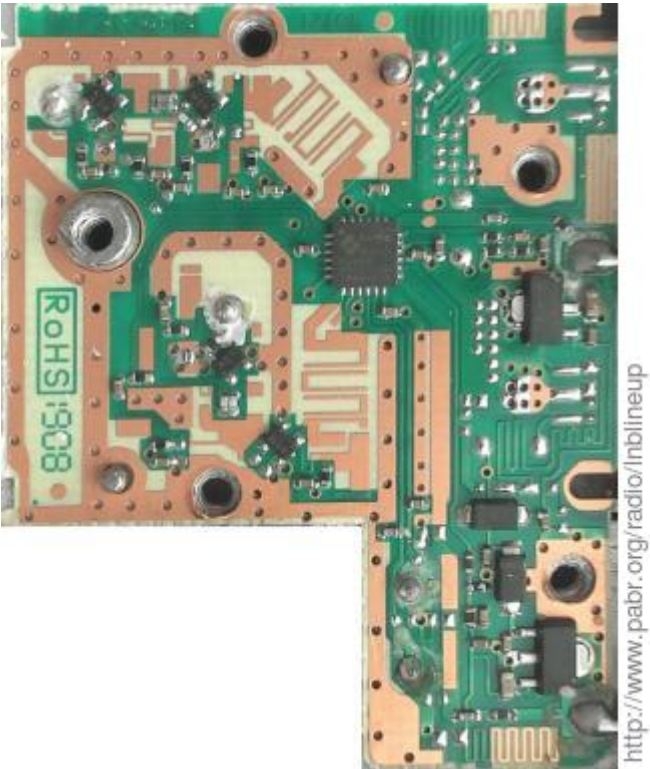


[Random](#)

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6.15. HB-Digital UHD 202 S 201901 (Gecen GKF-2132 ?)



(Click image to enlarge)

A modern Twin PLL model with a clean layout.

Related model . Very similar to the UHD 414 201705 ([Section 6.19, “HB-Digital UHD 414 201705 \(Gecen GKF-2134Q ?\)”](#)), except with a Rafael Micro RT320 IC

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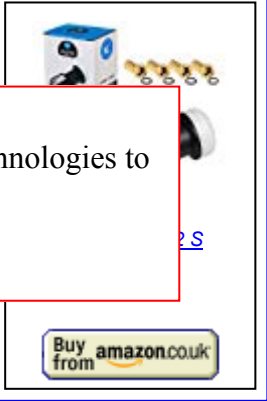
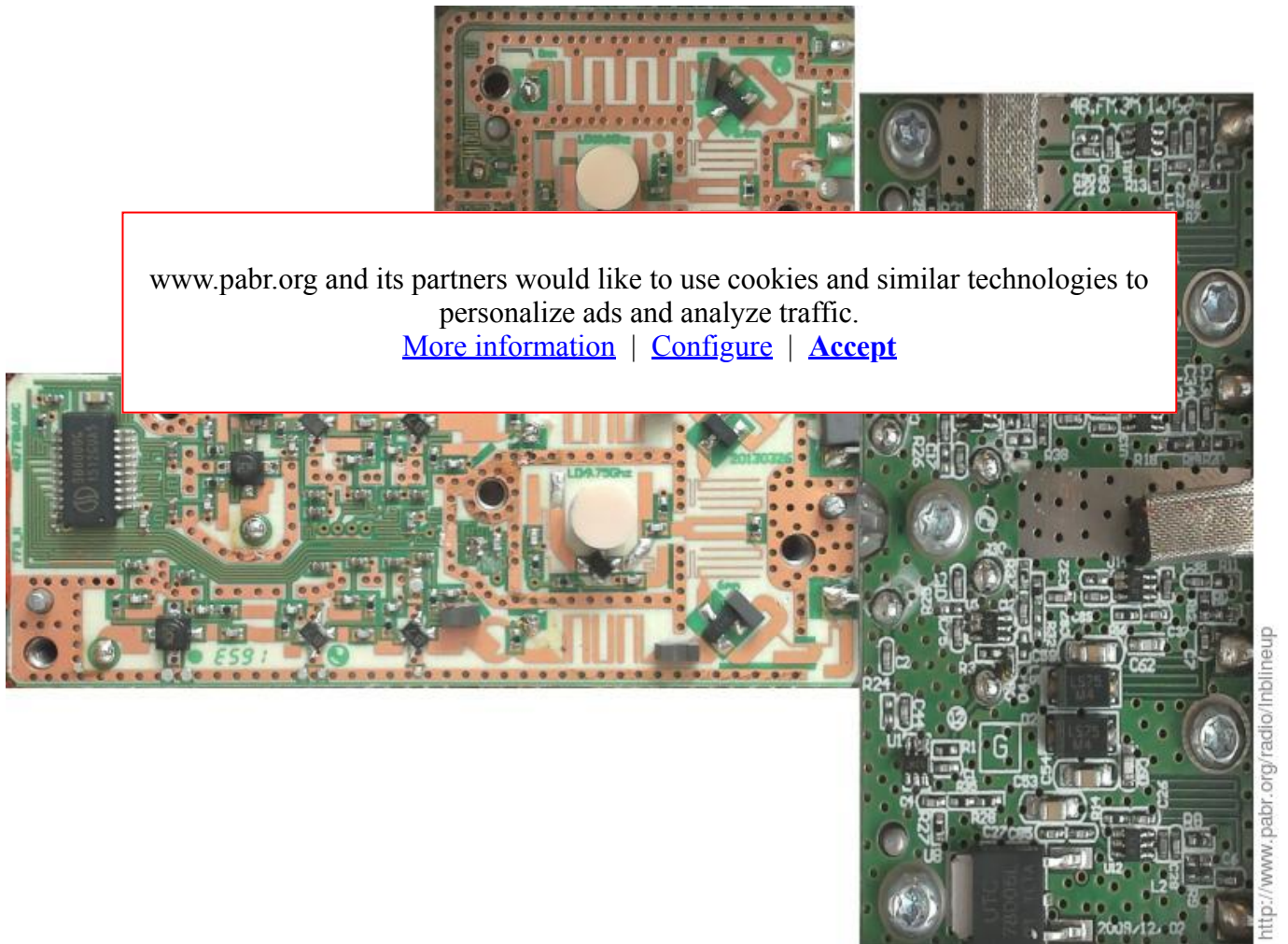


Table 17. HB-Digital UHD 202 S 201901 data

Type	Twin	
Unit price (approx)	13	EUR,USD
Neck diameter	40	mm
Neck length	42	mm
Aperture diameter	47	mm
Cap diameter	55	mm
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	37x46	mm ²
Bias IC		
Stage 1	A5T (x2)	
Stage 2	A5M (x2)	
Crystal	25 ?	
Rated L.O. accuracy		kHz
over temperature range		kHz
PLL/mixer IC	RT320	
Regulator	78H06 (x2)	
Rated current		mA
Screws	5	
RF pads	3	
Labels	CE	

6.16. Pro-Line P-40



(Click image to enlarge)

A sophisticated design with RF gaskets and two layers of shielding, but with DROs rather than PLLs. Four transistor-based mixers feed into a dedicated PCB with the Quattro outputs.

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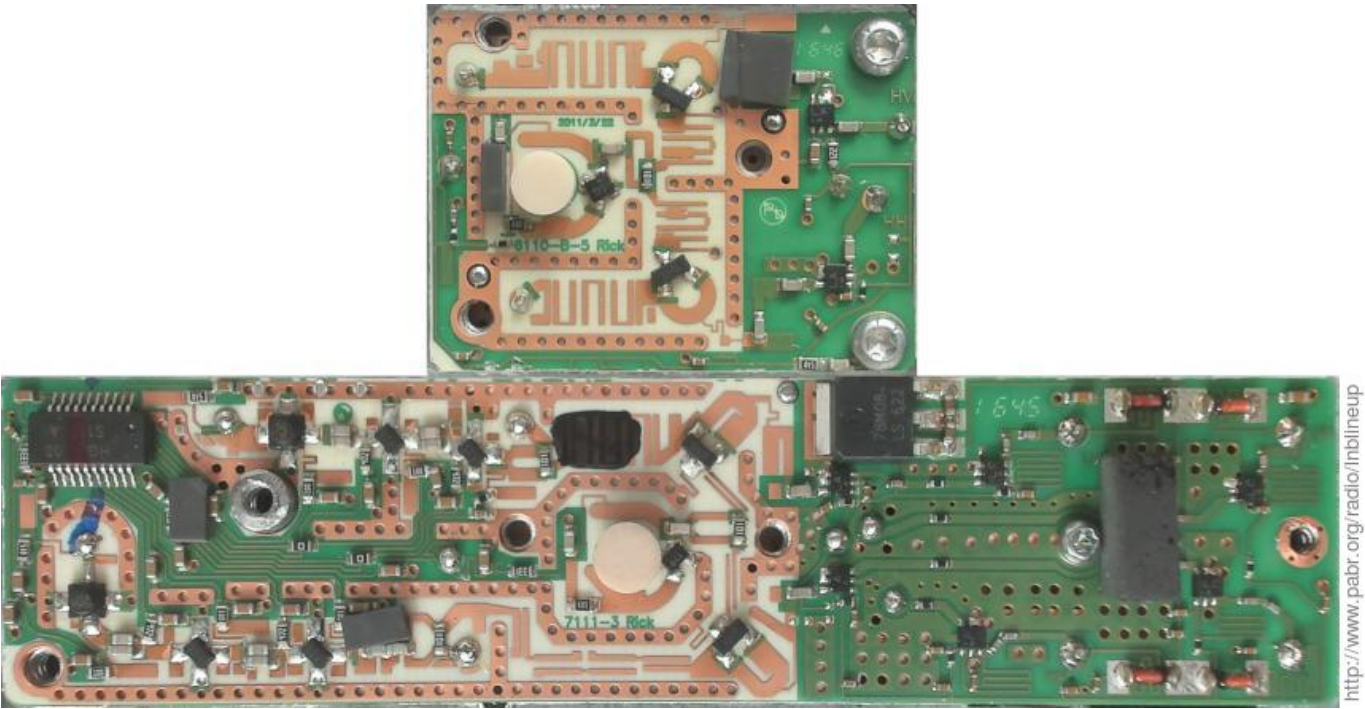
[LNB P-40](#)

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Table 18. Pro-Line P-40 data

Type	Quattro	
Unit price (approx)	18	EUR,USD
Neck di	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept	
Neck le		
Apertur		
Cap dia		
Rated noise factor		dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	65x24 + 32x28 + 30x65	mm²
Bias IC	SB6000G 1512GUA5	
Stage 1	68 C A103 (x2)	
Stage 2	B7 (x4)	
Crystal	DRO + NEt (x2)	
PLL/mixer IC	XH8 (x4)	
Regulator	78D06L	
Screws	4	
Metric screws	6	
Labels	CE	

6.17. Venton EXL-Q



(Click image to enlarge)

A sophisticated "bullet" model with two layers of shielding, but with DROs rather than PLLs. It has a short 23 mm diameter neck followed by a 40 mm diameter section. Interesting use of some kind of ink to tune one microstrip pattern.

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Table 19

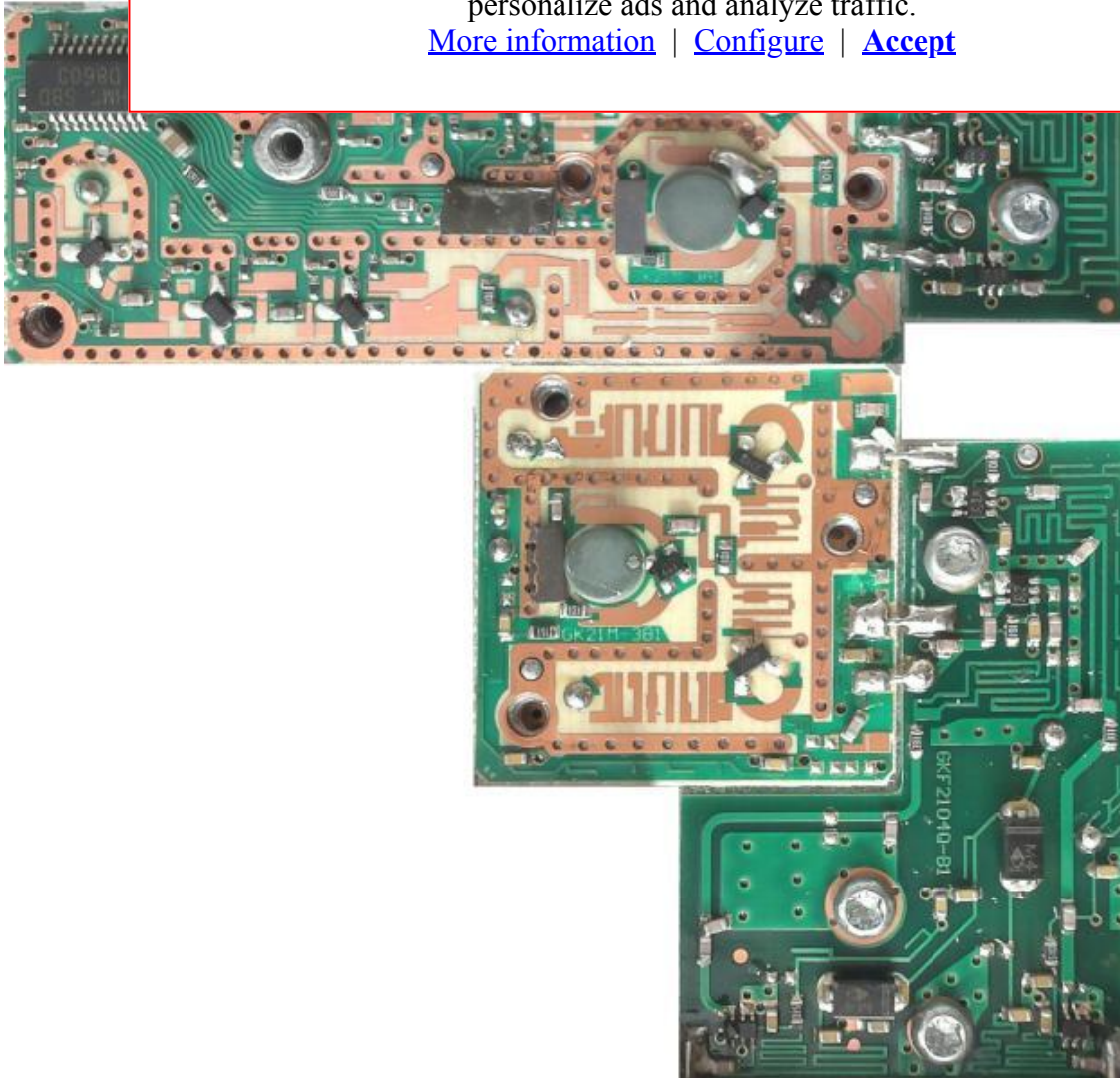
Type	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept	
Unit price		
Neck diameter		
Neck length	22	mm
Aperture diameter		mm
Cap diameter	30	mm
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	101x25 + 37x28	mm ²
Bias IC	HG 6000 S1428A	
Stage 1	61 C A113 (x2)	
Stage 2	V75 (x4)	
Crystal	DRO + T79/GG (x2)	
PLL/mixer IC	XH8 (x4)	
Regulator	78M08	
Screws	9	
RF pads	13	
Labels	CE	

6.18. HB-Digital UHD 414 201612 (Gecen GKF-2104Q ?)



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http://www.pabr.org/radio/lnblneup

(Click image to enlarge)

A compact and inexpensive Quattro model.

The circuit is spread over four boards, presumably to minimize the area of expensive low-loss substrate for the microwave sections.

Related model . There is a more recent version with the same name and SKU but a PLL circuit: [Section 6.19, “HB-Digital UHD 414 201705 \(Gecen GKF-2134Q ?\)”](#). The four F-type connectors are rotated 180°; there are no other external differences except the serial numbers.

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[LNB UHD 414 \(random DRO/PLL\)](#)

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Table 20. HB-Digital UHD 414 201612 data

Type	Quattro	
Unit price (approx)	10	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60 ?	dB
Rated flatness/26MHz	0.5 ?	dB
PCB size	89x46 + 44x48	mm ²
Bias IC	CHMC SBD D8600	
Stage 1	V75 (x2)	
Stage 2	V75 (x2)	
Stage 3	V75 (x2)	
Crystal	DRO + T79 (x2)	
Rated L.O. accuracy		kHz
over temperature range		kHz
PLL/mixer IC	XH8 (x4)	
Regulator	78M06	
Rated current		mA
Screws	7 + 5	
RF pads	4	
Labels	CE	

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6.19. HB-Digital UHD 414 201705 (Gecen GKF-2134Q ?)



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(Click image to enlarge)

A modern Quattro PLL model with a clean layout thanks to the dedicated NXP IC. The through-hole crystal is mounted on the back side.

A notch in the top sidewall makes it easy to lift the cover.

The Low/H output is noisier than the other three. Maybe this is related to the fact that vertical polarization uses a different (better ?) first-stage transistor.

Related model . There is an earlier version with the same name and SKU but a DRO circuit ([Section 6.18, “HB-Digital UHD 414 201612 \(Gecen GKF-2104Q ?\)”](#)). The four F-type connectors are rotated 180°; there are no other external differences except the serial numbers.

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[LNB UHD 414 \(random DRO/PLL\)](#)

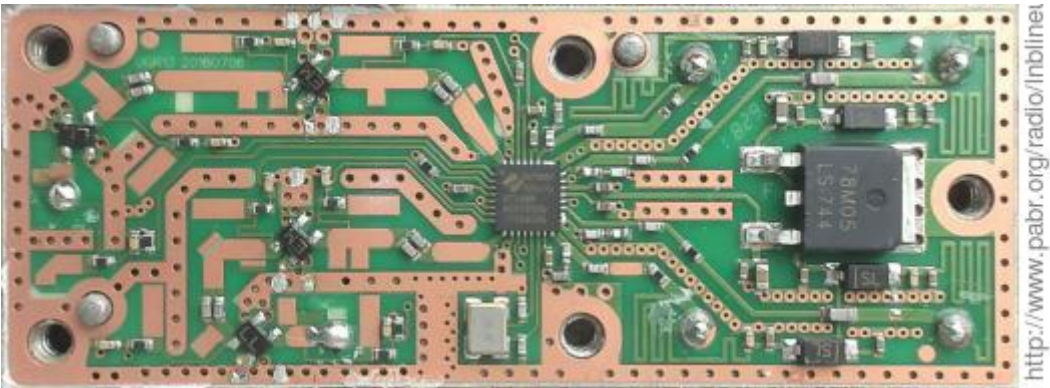
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Table 21. HB-Digital UHD 414 201705 data

Type	Quattro	
Unit price (approx)	14	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain	60 ?	dB
Rated flatness/26MHz	0.5 ?	dB
PCB size	37x46	mm²
Bias IC		
Stage 1	H.B., 3513 116q	
Stage 2	H.B. (x2)	
Crystal	25 ?	
Rated L.O. accuracy	1000 ?	kHz
over temperature range	2000 ?	kHz
PLL/mixer IC	NXP T1044	
Regulator	78H06 (x4)	
Rated current	220 ?	mA
Screws	5	
RF pads		
Labels	CE	

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6.20. Triax 304832



(Click image to enlarge)

A recent, somewhat expensive model with Quattro outputs in the same form factor as a Single LNB. Beautiful board layout based on the Rafael Micro RT348M.

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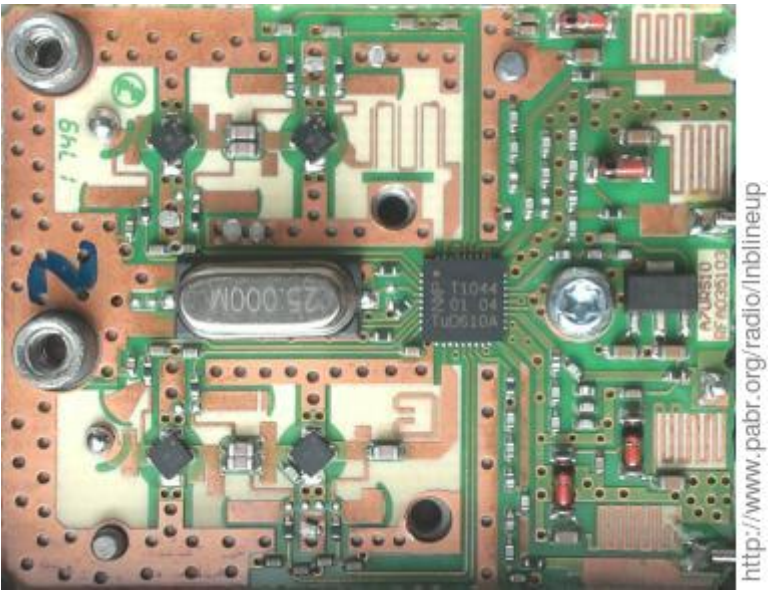
Its main distinguishing feature is a low-profile SMD crystal.

Table 22. Triax 304832 data

Type	Quattro	
Unit price (approx)	30	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
F/D	0.8	
Rated noise factor	0.3	dB
Rated gain	55..65	dB
Rated flatness/26MHz	8 ?	dB
PCB size	61x23	mm²
Bias IC		
Stage 1	LL (x2)	
Stage 2	EM (x2)	
Crystal	.25.OY	
over temperature range	1500	kHz
PLL/mixer IC	RT348M	
Regulator	78M05	
Rated current	130? 265?	mA
Screws	5	
Labels	CE	

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6.21. Opticum LRP-04H



(Click image to enlarge)

An intriguing model with a heavy inner shield over the microwave section plus a thin cover for the whole electronic cavity. This is usually seen only in DRO designs.

Hard to disassemble.

Elegant layout with a PLL/mixer IC, a NXP T1044, a 78D05, a 25.000M crystal, 3513 118n (x2) and 3513 118n (x2) reach beyond the PCB.



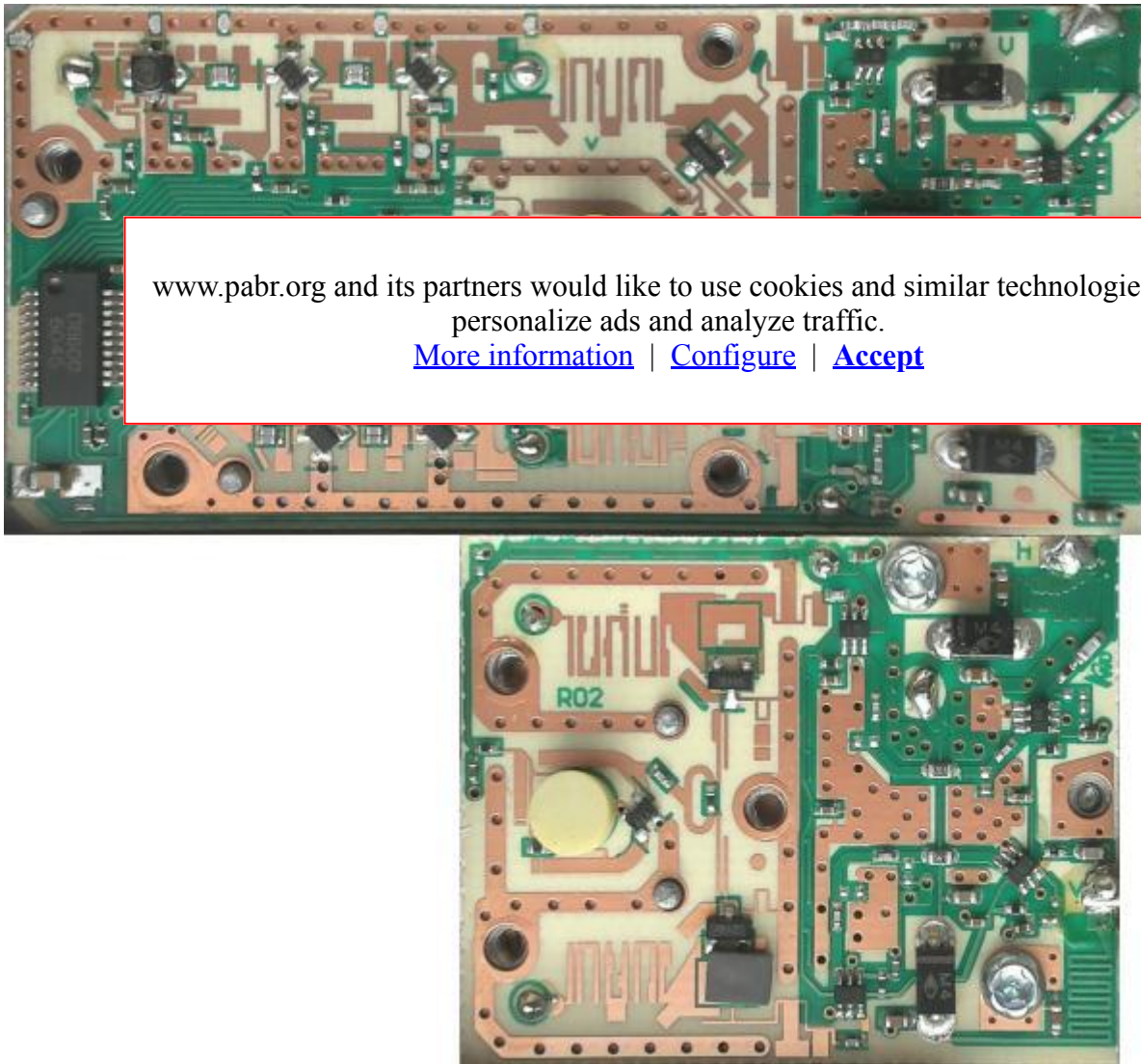
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Table 23

Type	Quattro	
Unit price (approx)	14	EUR,USD
Neck diameter	40	mm
Neck length	32	mm
Aperture diameter		mm
Cap diameter	60	mm
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	44x35	mm ²
Stage 1	3513 118n (x2)	
Stage 2	3513 118n (x2)	
Crystal	25.000M	
PLL/mixer IC	NXP T1044	
Regulator	78D05	
Screws	6	
RF pads	3	
Labels	CE	

6.22. PremiumX Deluxe Quattro



(Click image to enlarge)

An expensive Quattro model, well shielded, but using DROs. Very hard to disassemble.

Affiliate links



[LNB PremiumX](#)

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Table 24. PremiumX Deluxe Quattro data

Type	Quattro	
Unit price (approx)	35	EUR,USD
Neck di		
Neck le		
Apertur		
Cap dia		
Rated noise factor	0.1	dB
Rated gain		dB
Rated flatness/26MHz		dB
PCB size	71x33 + 43x33	mm²
Bias IC	D8600 6045	
Stage 1	62 C A0B3 (x2)	
Stage 2	V75 (x2)	
Stage 3	V75 (x2)	
Crystal	DRO + T79 (x2)	
PLL/mixer IC	4R S 64 (x2), 4R S 59 (x2)	
Regulator	78D06L	
Screws	10	
RF pads	8	
Labels	CE	

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6.23. Inverto 5448



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(Click image to enlarge)

A modern Quattro PLL design with heavy shielding and a square waveguide. SMD crystal and Rafael Micro RT348M mixer.

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Table 25. Inverto 5448 data

Type	Quattro	
Unit price (approx)	25	EUR,USD
Neck di	www.pabr.org and its partners would like to use cookies and similar technologies to personalize ads and analyze traffic. More information Configure Accept	
Neck le		
Apertur		
Cap dia		
F/D		
Rated noise factor	0.2 (typ), 0.7 (max)	dB
Rated gain	55 (min)	dB
Rated flatness/26MHz	0.6	dB
PCB size	51x50	mm ²
Stage 1	82 15 414X (x2)	
Stage 2	82 15 414X (x2)	
Crystal	JF25.000	
Rated L.O. accuracy	500	kHz
over temperature range	1000	kHz
PLL/mixer IC	RT348M	
Regulator	78M06 (x4)	
Rated current	240	mA
Screws	1+7	
Labels	CE	

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Revision History		
1.0	2018-11-01	Initial release.
1.1	2018-12-06	Added UHD414, T304832, LRP04H, PXDL. Notes on power circuits, crystals, supply chain, OSLO 45°.
1.2	2019-10-21	Added Inverto5448, UHD202S, note on OQSLG.

<http://www.pabr.org/radio/lnbl lineup/lnbl lineup.en.html>

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